10. (Thrice Amended) A process according to Claim 7, wherein:

said other one of the two layers is deposited onto said moving conveyor and is formed exclusively by said intimately blended commingled threads;

said one of the two layers is deposited on said other one of the two layers and is formed of at least one continuous commingled thread containing glass filaments and filaments of a thermoplastic organic material;

a third layer formed exclusively by commingled threads of glass filaments and filaments of a thermoplastic organic material is deposited onto said one of the two layers,

a fourth layer is deposited on said third layer, said fourth layer being formed of commingled threads of glass filaments and filaments of a thermoplastic organic material;

a combination of said two layers, said third layer and said fourth layer thus formed is transferred into a first zone where said combination is heated, and then into a second zone where said combination is simultaneously compressed and heated;

said combination is transferred into a third zone where said combination is compressed and cooled; and

the combination thus cooled is cut up at an exit of the third zone.

12. (Thrice Amended) A process according to Claim 1, a weight of said glass filaments deposited in total represents at least half of the total weight of the two layers deposited onto the moving conveyer.--

REMARKS

Favorable reconsideration of this application, as presently amended and in light of the following discussion, is respectfully requested.

Claims 1 and 5-14 are presently pending in this application, Claims 1, 8-10 and 12 having been amended by the present amendment.

In the outstanding Office Action, Claims 1 and 5-14 were rejected under 35 U.S.C. §103(a) as being unpatentable over Francis (U.S. Patent 2,543,101) in view of O'Conner (U.S. Patent 4,800,113), and alternatively further in view of PCT WO 90/14457 (refer to WO '457 hereinafter).

Claims 1, 8-10 and 12 have been amended to further clarify their claimed subject matter. Hence, these claim amendments are not believed to raise a question of new matter.

Briefly, the present invention is directed to a method for continuously manufacturing a reinforced thermoplastic composite having a high glass fiber content. According to Claim 1 of the present invention, a method for continuously manufacturing a composite product includes providing a strip of fabric formed by glass threads including at least a portion of intimately blended commingled threads containing glass filaments and filaments of thermoplastic organic material, and a plurality of continuous threads including at least 80% by weight of intimately blended commingled threads containing glass filaments and filaments of thermoplastic organic material; depositing onto a moving conveyor two layers, one of the two layers including the plurality of continuous threads in a form of at least one of continuous threads continuously deposited in a direction of movement of the moving conveyor, continuous threads continuously deposited in a form of superposed loops and continuous threads continuously deposited in a form of chopped threads, and the other one of the two layers including the strip of fabric; transferring the two layers combined through a plurality of zones where the two layers are heated and cooled while being simultaneously compressed to from a continuous composite material; and at least one of cutting up the continuous composite material into a plurality of sheets and winding the continuous composite material

onto a rotating drum. According to Claim 1, the glass filaments deposited in the process in total comprise more than 40 % by weight of the glass filaments and the filaments of thermoplastic organic material deposited in the process.

By providing such continuous threads and a strip of fabric and depositing them onto a moving conveyor for combining, a composite material whose content of reinforce fibers is exceedingly high is continuously manufactured.[1] In addition, because of the glass threads contained in the continuous threads deposited in a direction of movement of the moving conveyor, continuous threads deposited in a form of superposed loops, and continuous threads continuously deposited in a form of chopped threads and the layer of a fabric strip formed by glass threads containing intimately blended commingled threads of glass and thermoplastic filaments, lamination of the fabric strip and the continuous threads deposited in a direction of movement of the moving conveyor, continuous threads deposited in a form of superposed loops, or continuous threads continuously deposited in a form of chopped threads readily promotes a high content of reinforcing fibers evenly throughout the composite product. As a result, the manufacturing method of the present invention allows to produce continuous composite products whose strength is equal or higher than those manufactured simply by increasing glass content.[2]

Francis discloses a method for manufacturing a composite product having a layer of prefabricated textile material and a layer of felt-like material.[3] The general object of Francis is to provide a felt-like fibrous bat,[4] and thus according to Francis, this "composite product"

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[1] Id. page 15, lines 7-11.

[2] Id. lines 28-38.

[3] Francis, column 1, lines 1-7.

[4] Id. column 1, line 40 to column 2, line 14.

has one surface of the layer of felt-like material being exposed while the other surface is anchored to the prefabricated textile material. However, Francis does not teach providing a strip of fabric formed by glass threads including at least a portion of intimately blended commingled threads containing glass filaments and filaments of thermoplastic organic material, and a plurality of continuous threads including at least 80% by weight of intimately blended commingled threads containing glass filaments and filaments of thermoplastic organic material; depositing onto a moving conveyor two layers, one of the two layers including the plurality of continuous threads in a form of at least one of continuous threads continuously deposited in a direction of movement of the moving conveyor, continuous threads continuously deposited in a form of superposed loops and continuous threads continuously deposited in a form of chopped threads, and the other one of the two layers including the strip of fabric. On the other hand, Francis discloses how to bond "non-adhesive fibers" onto a textile fabric by using "potentially adhesive fibers", thereby making a felt-like product described above. As such, Francis does not disclose the providing step as recited in Claim 1.

Furthermore, Francis states that "the invention has the advantage that very light weight, thick, felt-like structures may be obtained which are characterized by low density, high porosity and permeability, without sacrifice of firmness or tensile strength."[5] On the other hand, Applicants' composite product is in the form of a sheet ready to be molded, i.e., a rigid, substantially not porous, nearly flat and usually thin in comparison to its length and breadth material, and the reinforcing glass fibers in a significant amount (more than 40% by weight) are well wetted by the thermoplastic material. Since Applicants' composite product

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[5] Id., column 11, line 52-56.

is formed by simultaneously heating and compressing the commingled threads of thermoplastic filaments and glass filaments, Applicants' composite products can be easily molded to form glass-reinforced thermoplastic articles without any delaminating problems. Thus, it is respectfully submitted that Francis does not suggest or teach producing a dense composite product by applying a greater pressure.

On these bases, Applicants respectfully submit that the process disclosed in Claim 1 is clearly distinguishable from Francis.

O'Connor discloses a method of producing a composite product using co-mixed fibers either in the form of a fabric or in the form of a chopped strand mat. However, O'Connor does not teach the providing and depositing steps as recited in Claim 1. Instead, O'Connor teaches "*intermingling* at least one fibrous thermoplastic material and at least one fibrous reinforcement material to produce a composite yarn, *weaving* the composite yarn into a fabric, *and heating* the fabric..."[6] (emphasis added in Italics). O'Connor therefore does not disclose providing a fabric strip and continuous threads, and depositing these two components onto a moving conveyor for manufacturing a composite product as recited in Claim 1. Furthermore, even if O'Conner discloses the use of commingled yarns made of thermoplastic fiber and reinforcement fibers to weave a fabric to be heated to produce a reinforced article, it is not obvious to use such yarns in the process of Francis in order to have the composite product in the form of a sheet suitable for molding. Accordingly, the process recited in Claim 1 is distinguishable from O'Connor.

why not?

[6] O'Conner, column 1, line 67 to column 2, line 4.

WO '457 simply discloses a method for producing a fiber reinforced plastic material, and does not teach the providing and depositing steps as recited in Claim 1. Thus, the process recited in Claim 1 is also distinguishable from WO '457.

Since none of Francis, O'Conner and WO '457 teaches the providing and depositing steps as recited in Claim 1, even the combined teachings of these cited references would not in any way obviate the process recited in Claim 1.

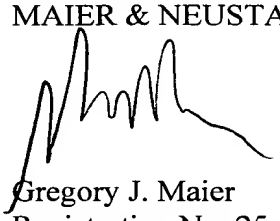
Similarly, since independent Claims 13 and 14 include subject matter substantially similar to what is recited in Claim 1, Claims 13 and 14 are also distinguishable from Francis, O'Conner and WO '457.

For the foregoing reasons, Claims 1, 13 and 14 are believed to be allowable. Furthermore, because Claims 5-12 ultimately depend from Claim 1, substantially the same arguments set forth above also apply to these dependent claims. Hence, Claims 5-12 are believed to be allowable as well.

In view of the amendments and discussions presented above, it is respectfully submitted that the present application is in condition for allowance, and an early action favorable to that effect is earnestly solicited.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.



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IN THE CLAIMS

Please amend Claims 1, 8-10 and 12 as follows:

--1. (Five Times Amended) A process for continuously manufacturing a composite product by associating glass threads and a thermoplastic organic material in a filamentary state, comprising the steps of:

providing a strip of fabric formed by glass threads including at least a portion of intimately blended commingled threads containing glass filaments and filaments of thermoplastic organic material, and a plurality of continuous threads including at least 80% by weight of intimately blended commingled threads containing glass filaments and filaments of thermoplastic organic material;

depositing onto a moving conveyor two layers, one of the two layers [being made of at least one] including said plurality of continuous threads [deposited] in a form of at least one of continuous threads continuously deposited in a direction of movement of said moving conveyor, continuous threads continuously deposited in a form of superposed loops[,] and continuous threads continuously deposited in a form of chopped threads, [said one of the two layers including at least 80% by weight of intimately blended commingled threads containing glass filaments and filaments of thermoplastic organic material,] and the other one of the two layers including [a] said strip of fabric [formed by glass threads including at least a portion of commingled threads containing glass filaments and filaments of thermoplastic organic material];

transferring said two layers combined through a plurality of zones where said two layers are heated and cooled while being simultaneously compressed to form a continuous composite material; and

at least one of cutting up said [two layers] continuous composite material into a plurality of sheets and winding said [two layers] continuous composite material onto a rotating drum,

wherein said glass filaments deposited in said process in total comprise more than 40 % by weight of said glass filaments and said filaments of thermoplastic organic material deposited in said process.

8. (Thrice Amended) A process according to Claim 7, wherein:

said one of the two layers is deposited on said moving conveyor and is formed of said chopped threads;

said other one of the two layers is deposited on said one of the two layers and is formed exclusively by said intimately blended commingled threads;

a third layer of chopped intimately blended commingled threads of glass filaments and filaments of a thermoplastic organic material is deposited onto said other one of the two layers;

a combination of said two layers and said third layer thus formed is transferred into a first zone where said combination is heated and then into a second zone where said combination is simultaneously compressed and heated;

said combination is then transferred into a third zone where said combination is compressed and cooled; and

said combination thus cooled is cut up at an exit of the third zone.

9. (Thrice Amended) A process according to Claim 7, wherein:

said other one of the two layers is deposited on said moving conveyor and is formed exclusively of said intimately blended commingled threads;

said one of the two layers is deposited on said other layer and is formed of said chopped threads;

a third layer exclusively formed by intimately blended commingled threads of glass filaments and filaments of a thermoplastic organic material is deposited onto said one of the two layers;

a fourth layer of chopped intimately blended commingled threads of glass filaments and filaments of a thermoplastic organic material is deposited onto said third layer;

a combination of said two layers, said third layer and said fourth layer thus formed is transferred into a first zone where said combination is heated, and then into a second zone where said combination is simultaneously compressed and heated;

said combination is transferred into a third zone where said combination is compressed and cooled; and

the combination thus cooled is cut up at an exit of the third zone.

10. (Thrice Amended) A process according to Claim 7, wherein:

said other one of the two layers is deposited onto said moving conveyor and is formed exclusively by said intimately blended commingled threads;

said one of the two layers is deposited on said other one of the two layers and is formed of at least one continuous commingled thread containing glass filaments and filaments of a thermoplastic organic material;

a third layer formed exclusively by commingled threads of glass filaments and filaments of a thermoplastic organic material is deposited onto said one of the two layers,

a fourth layer is deposited on said third layer, said fourth layer being formed of commingled threads of glass filaments and filaments of a thermoplastic organic material;

a combination of said two layers, said third layer and said fourth layer thus formed is transferred into a first zone where said combination is heated, and then into a second zone where said combination is simultaneously compressed and heated;

said combination is transferred into a third zone where said combination is compressed and cooled; and

the combination thus cooled is cut up at an exit of the third zone.

12. (Thrice Amended) A process according to Claim 1, a weight of said glass filaments deposited in total represents at least half of the total weight of the two layers deposited onto the moving conveyer.--